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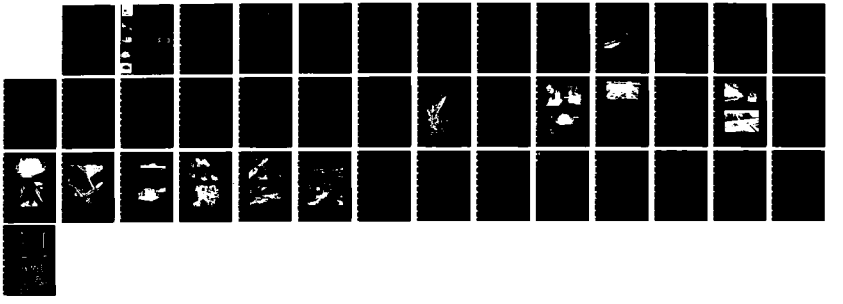

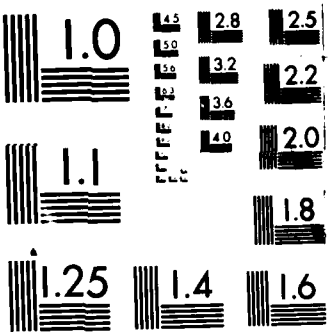

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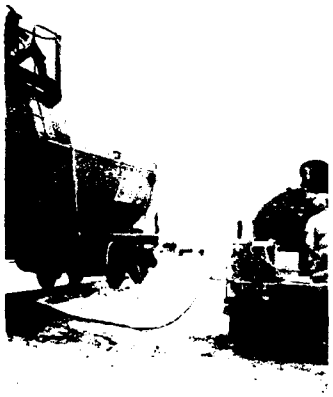

GEOTECHNICAL LABORATORY

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TECHNICAL REPORT GL-85-11

DUSTPROOFING UNSURFACED AREAS; FACILITIES TECHNOLOGY APPLICATION TEST DEMONSTRATIONS, FY 84

by

Clarence R. Styron III, Robert A. Hass, Karen Kelley

Geotechnical Laboratory

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Waterways Experiment Station, Corps of Engineers
PO Box 631, Vicksburg, Mississippi 39180-0631

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The problem of dust caused by vehicular traffic is discussed. Site preparation and two different materials for dust control are presented. Equipment needed for dust control projects, equipment modifications suggested, dust control material properties including costs, and expected maintenance are discussed in detail.

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PREFACE

This study was sponsored by the Office, Chief of Engineers, US Army, as a part of the O&MA Program, Facilities Technology Application Tests (FTAT), Demonstration Program FY 84.

The project was conducted under the general supervision of Dr. W. F. Marcuson III, Chief, Geotechnical Laboratory; and under the direct supervision of Messrs. H. H. Ulery, Jr., Chief, Pavement Systems Division (PSD); Mr. J. W. Hall, Jr., Chief, Engineering Investigation, Testing, and Validation Group, PSD; and Dr. E. R. Brown, Chief, Material Research Center, PSD. The US Army Engineer Waterways Experiment Station (WES) FTAT project manager was CPT R. A. Hass. This report was prepared by Mr. C. R. Styron III, CPT Hass, and Ms. K. Kelley and was edited by Ms. Odell F. Allen, Publications and Graphic Arts Division.

Director of WES was COL Allen F. Grum, USA. Technical Director was Dr. Robert W. Whalin.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
Fahrenheit degrees	5/9	Celsius degrees or Kelvins*
feet	0.3048	metres
gallons (US liquid)	0.003785412	cubic metres
gallons (US liquid) per square yard	4.5273149	cubic decimetres per square metre
inches	2.54	centimetres
miles per hour	1.609347	kilometres per hour
square feet	0.09290304	square metres
square yards	0.8361274	square metres
tons (2,000 pounds, mass)	907.1847	kilograms
yards	0.9144	metres

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use $K = (5/9)(F - 32) + 273.15$.

DUSTPROOFING UNSURFACED AREAS; FACILITIES TECHNOLOGY APPLICATION TEST DEMONSTRATIONS, FY 84

PART I: INTRODUCTION

History

1. Dust has been a long time enemy of the military. Dust occurs wherever military equipment operates over dry unsurfaced terrain. The amount of dust realized is directly proportional to the type and number of military vehicles operating, the duration of the particular activity, and the weather (moisture) condition during the activity.

2. In Southeast Asia (SEA), the presence of dust control problems in areas subjected to cargo aircraft, helicopter, and ground vehicle traffic was emphasized by decreased logistical capabilities in the SEA theater of operations. The rotary blades of helicopters required replacing after only 200 to 300 hr of operation rather than after the 1,100 hr expected, and the engines of helicopters required replacing after only one-third to one-half the normal usage period. Dust clouds around military installations provided the enemy with easily recognizable signatures of strategic operations and impaired visibility of both airborne and ground personnel. In addition, safety and health hazards as well as low morale resulted from continuous exposure of personnel to extreme dust conditions. Since the available dust control materials were not effective on the various soil conditions encountered in the SEA theater of operations, the necessity for developing a material capable of controlling the extreme conditions was accentuated.

3. The US Army Engineer Waterways Experiment Station (WES) investigated 315 materials in a 7-year program involving both laboratory tests and field tests of the most promising laboratory materials (Styron and Eaves 1973). A polyvinyl acetate (PVA) liquid emulsion was selected as having the greatest potential for meeting the requirements for military purposes.

4. Today, military maneuvers are usually on military reservations; however, these maneuvers produce dust with similar consequences to those mentioned above. Indeed, the main dust control problem may occur as the vehicles proceed from the motor pool to the training area. The route these vehicles

must take may be near family housing or adjacent to nearby commercial enterprises where dust is especially undesirable.

Occurrence

5. Dust occurs when small surface particles are scraped or rubbed away from the traveled surface by a vehicle tire or track and carried airborne by wind forces (in wet weather the same abraded particles are washed away in the form of mud). One vehicle crossing an open field will not usually produce an objectionable amount of dust. The objectionable large blinding foglike clouds occur when many vehicles follow the same unsurfaced route. Perhaps the most familiar of these dust-producing routes is the gravel road. A good structural material for unsurfaced gravel roads is coarse aggregate with sufficient sand to fill the voids, and adequate clay to bind these materials. Abrasion of the small clay particles begins with the passage of the first vehicle. Gradually as more and more vehicles pass over the roadway, sufficient small particles are displaced so that the larger particles become unstable. Ruts begin to form. Soon maintenance will be required to reduce the severity and extent of rutting. If sufficient clay particles are not replaced to stabilize the larger particles, the time between succeeding maintenance periods will be reduced. A good dust control material resists the abrasion of the small particles and a more stable condition is realized over a longer time period.

Plan of Demonstration

6. Demonstration sites based on dust control need were selected, prepared, and treated at two military reservations within the continental United States. Each site was bladed to remove all loose material, prewet with water to reduce surface tension, and sprayed with a dust control material. The materials were applied with an Etnyre asphalt distributor after the pump had been modified to permit external lubrication.

7. Basic advantages and disadvantages of each product including cost are presented. A video cassette of the entire procedure and a list of contacts were prepared for those unable to attend either demonstration.

PART II: DEMONSTRATION

Site Selection

8. Fort Stewart, Ga., and Fort Bliss, Tex., were selected for the fiscal year 1984 demonstration sites. Both locations had an immediate need for dust control. Wheeled and tracked vehicles were producing dust on the silty sand roads, and this dust was blowing into the family housing area (Fort Stewart) and nearby adjacent commercial enterprises (Fort Bliss, Figure 1).

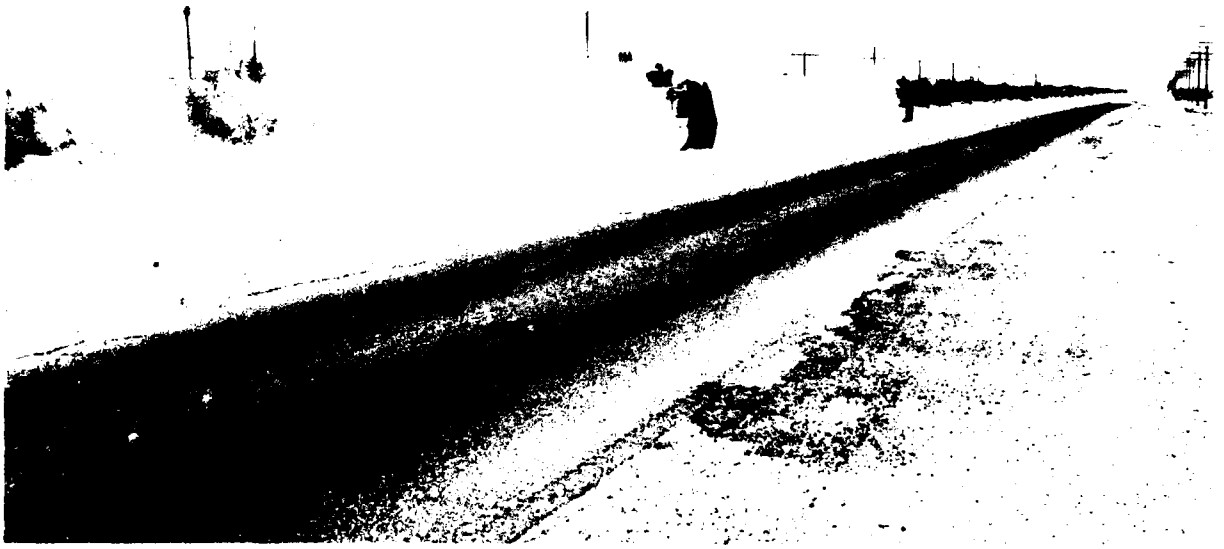

Figure 1. Dust at Fort Bliss, Tex., prior to treatment

Coordination

9. Messrs. Tommy Houston (Fort Stewart) and Enrique Rey (Fort Bliss) agreed to provide storage locations for the material and equipment. They also supplied personnel for site preparation as well as local contacts when necessary to accomplish the demonstrations. Firm dates for the demonstrations were coordinated with Messrs. Houston and Rey.

Logistics

10. Arrangements were made with the manufacturers for the dust control materials to be transported to each test site. The WES Etnyre distributor and operator, as well as photographers, technicians, and laborers, were scheduled for the appropriate time periods. Notices were sent to inform individuals who might be interested in the location, date, and time of each demonstration. Handouts and orientation talks were prepared for the observers. Appendix A lists the points of contact for this project.

PART III: PROJECT PROCEDURE

11. A considerable amount of preparation is required before dust control material is placed.

Construction Method Recommended

12. The area to be treated is bladed and prewet. Compact the bladed surface with a rubber-tired roller as necessary to achieve a hard surface that is not easily rutted by the using traffic. All loose material is removed and/or the remaining material is compacted. Water is required to reduce surface tension which helps ensure a uniform application of the dust control liquid over the applied area. The amount of prewet water is varied with surface condition/soil type and prevailing weather conditions, but it usually ranges between 0.03 and 0.10 gal/sq yd.* The prewet water should not be allowed to pond. Ponded water should be broomed away before application of the dust control material.

13. The dust control material is applied as a liquid (powdered or solid dust control materials are beyond the scope of this report). Most dust control liquids can be applied with a common asphalt distributor or even a gravity-fed water truck. Some require agitation during transport/application to prevent segregation of the emulsion, and some require special equipment (Headquarters, Departments of the Army and Air Force 1974). Regardless of the method of application, the rate of application for most dust control liquids for the initial application should be 0.50 gal/sq yd. Higher application rates invite runoff, and lower application rates are not efficient or effective. Subsequent application rates for maintenance of previously treated areas may be as low as 0.25 gal/sq yd depending upon the degree of maintenance required.

14. Close coordination is required between the driver and the operator so that the spray bar can be opened and closed at the proper location(s) and a 6- to 12-in. overlap onto the previously treated strip is maintained.

15. The dust control material is observed closely as it is applied to

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

the test area. If the test area is too dry caused from too little prewet water or evaporation of the prewet water, then the material will separate on the ground surface and not adequately coat the in-situ material. Such exposed areas have been termed fisheyes. The placement operation should be stopped whenever fisheyes occur, and additional prewet water placed before the application of the dust control material is resumed.

16. The dust control material is allowed to cure. Some dust control materials require 4 hr or longer to cure before traffic is allowed to use the treated area while others do not require any cure period. Sufficient cure must be allowed or dust control effectiveness is sacrificed. The degree of effectiveness sacrificed depends upon the actual cure time received versus the cure time required.

Materials Required

17. Two dust control materials were selected for the demonstration. The first was the PVA selected for use in SEA and is known to be effective on most soil types when subjected to foot or rubber-tired traffic. The second was magnesium chloride ($MgCl_2$), a product subjected to a limited series of tests at the WES and was determined to have potential for dust control when applied to unsurfaced gravel roads subjected to any type of vehicular traffic (excluding aircraft) (Styron and Spivey 1982).

18. PVA is a proprietary product consisting of a polyvinyl acetate emulsion modified with plasticizers, surfactants, and other inorganic elements. Before application, the as-received concentrate is diluted three parts concentrate to one part water for spraying purposes. This material closely resembles white latex paint. It dries in approximately 4 hr depending on the ambient weather conditions. The cured material forms a clear durable film over the treated area. The recommended application rate varies from 1/3 to 2/3 gal/sq yd depending on the treated areas' predicted use (Headquarters, Departments of the Army and Air Force 1974). Both the concentrate and the cured forms of this material are harmless with basic hygiene practices.

19. $MgCl_2$ is a commercial by-product of a mining operation. The amber liquid brine is composed mainly of $MgCl_2$ which is believed to be the primary dust control ingredient. The liquid is applied as received with no dilution necessary. The recommended application rate is 0.5 gal/sq yd. The liquid is

moderately corrosive but harmless with basic hygiene practices. No other unusual or significant materials other than the dilution water for the PVA and the water for prewetting are required.

Equipment Required

20. A motor grader is needed to blade the area to be treated, and a rubber-tired roller is also needed to compact the bladed surface. A water truck is used to prewet the surface. The PVA is best applied with a positive displacement pump. A common asphalt distributor can be used to apply the diluted PVA if the pump is first modified to permit external lubrication (Figure 2) since PVA is not a natural lubricant. Product $MgCl_2$ can also be applied with a modified asphalt distributor although the need for external lubrication is not quite as great in this instance. Product PVA will bind a nonlubricated pump requiring a complete pump breakdown and cleanup (regardless of what material is used, the asphalt distributor should be thoroughly cleaned and flushed with diesel fuel at the end of the project).

Personnel Required

21. Experienced operators are required for the motor grader, rubber-tired roller, water truck, and asphalt distributor. A civil engineering technician or an engineer familiar with dust control material application should be present when the material is being placed. Laborers are required for loading the dust control material(s) and dilution (if required) into the asphalt distributor.

Recommended Procedure for Dustproofing With $MgCl_2$

22. The following is the recommended procedure for dustproofing with $MgCl_2$:

a. Planning:

(1) Determine the area to be treated (square yards).

(2) Order enough $MgCl_2$ for an initial treatment at 0.50 gal/sq yd and plan for a follow-up maintenance application of 0.25 gal/sq yd after 10 to 14 months of service life.

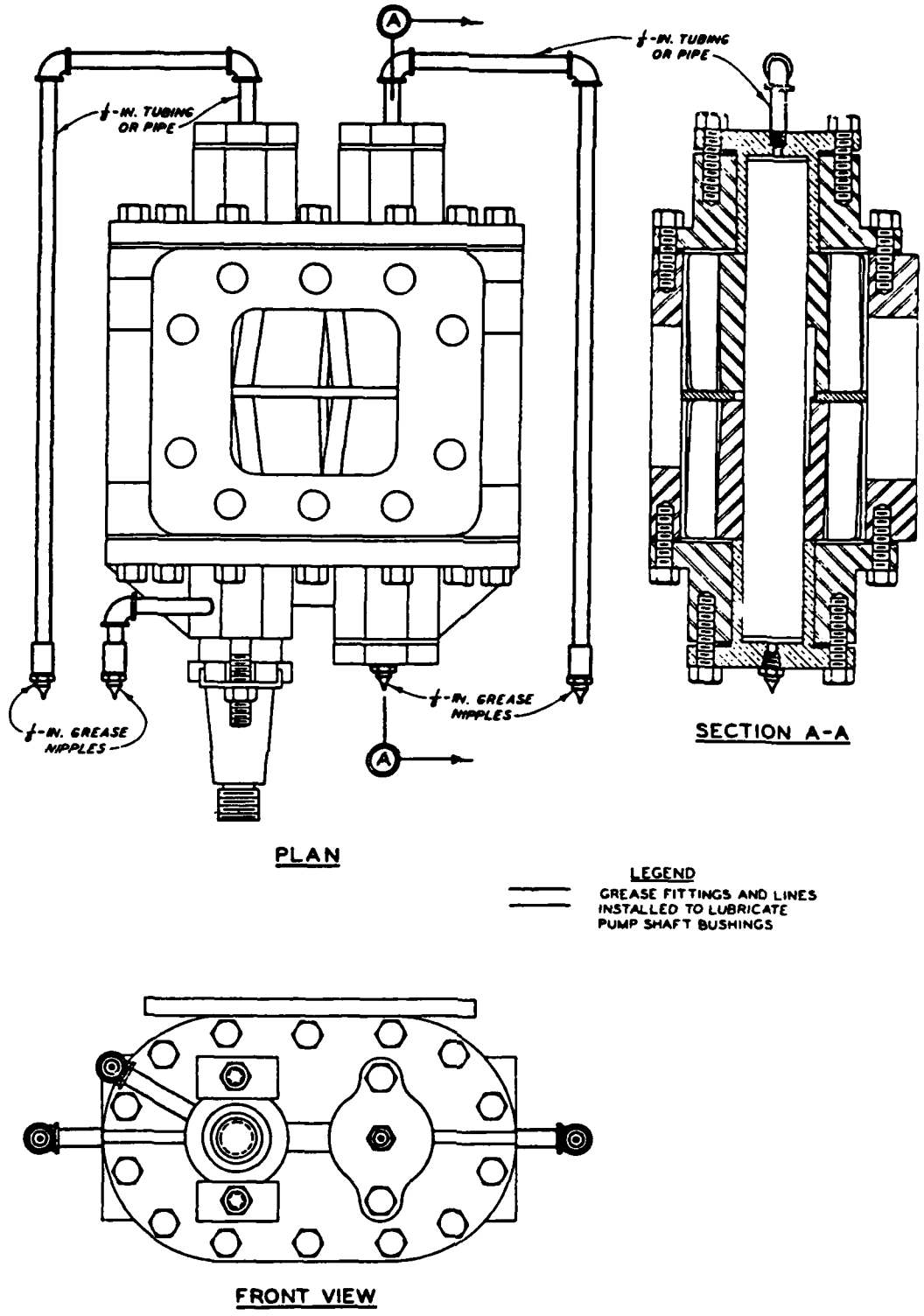

Figure 2. Typical pump modification requirements for conventional asphalt distributor

b. Equipment and personnel:

(1) Equipment:

(a) Standard motor grader to blade the area.

(b) A 5,000-gal water truck with pump to prewet the area. A smaller capacity water truck can be used; however, it should have a capacity twice that of the vehicle used to apply the $MgCl_2$.

(c) A rubber-tired roller to compact the area before prewetting and after $MgCl_2$ application.

(d) A modified asphalt distributor or a water truck capable of metered applicataion of $MgCl_2$.

(e) A 90- or 45-deg collar for the tank car which must fit a threaded pipe approximately 4-1/4 in. in diameter on the bottom of the tank car and the opposite end fit the 3-1/2-in. supply hose on the modified asphalt distributor.

(2) Personnel:

(a) Onsite foreman - 1.

(b) Water truck driver and pump operator - 2.

(c) Motor grader operator - 1.

(d) Rubber-tired roller operator - 1.

(e) Modified asphalt distributor operator and pump/spray bar operator - 2.

(f) Engineer or technician - 1.

(g) Total personnel - 8.

c. Site preparation:

(1) Blade away all ruts, potholes, and excess surface material.

(2) Compact the bladed surface with a rubber-tired roller as necessary to achieve a hard surface that is not easily rutted by the using traffic.

(3) Prewet the area to be treated to reduce surface tension and increase $MgCl_2$ penetration. Recommended application rate for prewetting is 0.10 gal/sq yd.

d. Material application:

(1) Spray the $MgCl_2$ with a modified asphalt distributor or apply the $MgCl_2$ with a water truck capable of metering liquids at an application rate of 0.50 gal/sq yd. Flush the vehicle thoroughly following each day's application with water and detergent. Normal hygiene procedures

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Note: The surface should be damp when $MgCl_2$ is applied. Puddles or ponded water should be swept away.

should be all that is required of the placement crew for their complete safety.

(2) Compact the treated area (again) with the rubber-tired roller to help ensure the stability of the smaller particles. Rolling should be halted or postponed if the tires pick up the small particles and/or cause tracks or dry ruts to form. This step may be eliminated if immediate traffic is anticipated/required (only for unsurfaced roads).

e. Maintenance:

(1) Following periods of low rainfall and for low humidity (humidity less than 30 percent), the hygroscopic properties of the $MgCl_2$ will be rendered ineffective (dormant) and dust will appear again. The $MgCl_2$ can be reactivated with an application of plain water at approximately 0.10-0.20 gal/sq yd. Periodic watering should be repeated as long as the dry period continues and whenever they occur.

(2) Blading will be substantially reduced. Only blade the treated area if rutting occurs.

(3) $MgCl_2$ and all salts leach from the treated soil area with continued exposure. A second application should be planned/anticipated following 10-14 months of service. The second application procedure is the same as the first, except $MgCl_2$ is applied at 0.25 gal/sq yd.

f. Safety:

(1) Local and Federal safety regulations apply.

(2) Hard hats should be worn.

(3) Normal hygiene practices should be all that is required if the $MgCl_2$ comes in contact with skin or clothes of the placement crew.

(4) The manufacturer's application recommendations and safety labels should be read.

Recommended Procedure for Dustproofing With PVA

23. The following is the recommended procedure for dustproofing with PVA:

a. Planning:

(1) Determine the area to be treated (square yards).

Note: The surface should be damp when PVA is applied. Puddles or ponded water should be swept away.

(2) Order enough PVA for an initial treatment at 0.50 gal/sq yd and plan for a follow-up maintenance application of 0.50 gal/sq yd after 10 to 14 months of service life.

b. Equipment and personnel:

(1) Equipment:

(a) Standard motor grader to blade the area.

(b) A 5,000-gal water truck with pump to prewet the area. A smaller capacity water truck can be used; however, it should have a capacity twice that of the vehicle used to apply the PVA.

(c) A modified asphalt distributor for application of PVA.

(2) Personnel:

(a) Onsite foreman - 1.

(b) Motor grader operator - 1.

(c) Water truck driver and pump operator - 2.

(d) Modified asphalt distributor operator and pump/spray bar operator - 2.

(e) Engineer or technician - 1.

(f) Total personnel - 7.

c. Site preparation:

(1) Blade away all ruts, potholes, and excess surface material.

(2) Prewet the area to be treated to reduce surface tension and increase PVA adhesion. Recommended application rate for prewetting is 0.10 gal/sq yd.

d. Material application:

(1) Spray the PVA with a modified asphalt distributor at an application rate of 0.50 gal/sq yd. Flush the vehicle thoroughly following each day's application with water and detergent. Normal hygiene procedures should be all that is required of the placement crew for their complete safety.

(2) Allow the PVA to cure for 24 hr before allowing light rubber-tired vehicle or helicopter traffic on the treated surface.

e. Maintenance:

(1) Do not allow vehicles equal to or larger than a 2-1/2-ton trucks to traffic the treated area.

(2) PVA is biodegradable and will dissolve from the treated soil area with continued exposure. A second application should be planned/anticipated following 10-14 months of

service. The second application procedure is the same as the first.

f. Safety:

(1) Local and Federal safety regulations apply.

(2) Hard hats should be worn.

(3) Normal hygiene practices should be all that is required if the PVA comes in contact with skin of the placement crew. Clothes can be ruined if PVA is allowed to dry on the material. Skin or clothes should be rinsed immediately with water and soap.

(4) The manufacturer's application recommendations and safety labels should be read.

PART IV: CONDUCT OF DEMONSTRATION

Fort Bliss, Tex.

24. The Fort Bliss, Tex., demonstration was conducted during the period 16 through 20 April 1984. Two test sites were bladed smooth, and a water truck was provided for prewetting.

25. Eighteen drums of PVA were diluted (three parts PVA to one part water) and applied to a nontraffic area measuring 110 by 180 ft. This area is adjacent to Bldg. 11246 located on Sixth Street at Biggs Army Airfield at Fort Bliss (Figure 3). The test area is essentially horizontal with little or no grade. The surface material is brown gravelly silty sand (classified as SP-SM according to the Unified Soil Classification System (USCS)) that dusts readily (Figure 4).

26. The WES 900-gal capacity modified asphalt distributor is capable of self-loading from drums (Figure 5). Thus, nine drums of PVA and three drums of water were loaded and mixed, and approximately one-half the area was treated. A 12-ft-wide spray bar was used to apply a strip the same width with each pass (Figure 6). The desired application rate was set by the distributor driver/operator as follows:

a. The pump controls were set on 120 gal/min.

b. The distributor speed was set on 180 ft/min. Thus, for a 12-ft-wide spray bar, the application rate is

$$\frac{120 \text{ gal/min}}{180 \text{ ft/min}} \times \frac{1 \text{ ft}}{12 \text{ sq ft}} \times \frac{9 \text{ sq ft}}{1 \text{ sq yd}} = 0.5 \text{ gal/sq yd}$$

The age of the distributor and the frequent starting and stopping with overlapping made it difficult to maintain the desired application rate. The larger the test area and the better the application equipment, the closer the driver/operator can approach the desired application rate. The actual rate applied here was 0.44 gal/sq yd.

27. The usual cure time averages 4 hr for good weather (sunny day, temperature 70° F and 60- to 80-percent humidity). This cure period was shortened considerably because of high winds gusting to 50 mph.

28. Small depressions and ruts (the treated surface caused by the distributor tires) were filled with PVA, and these ponded areas cured much more slowly than the nonrutted areas (Figure 7). The ponded material cures from

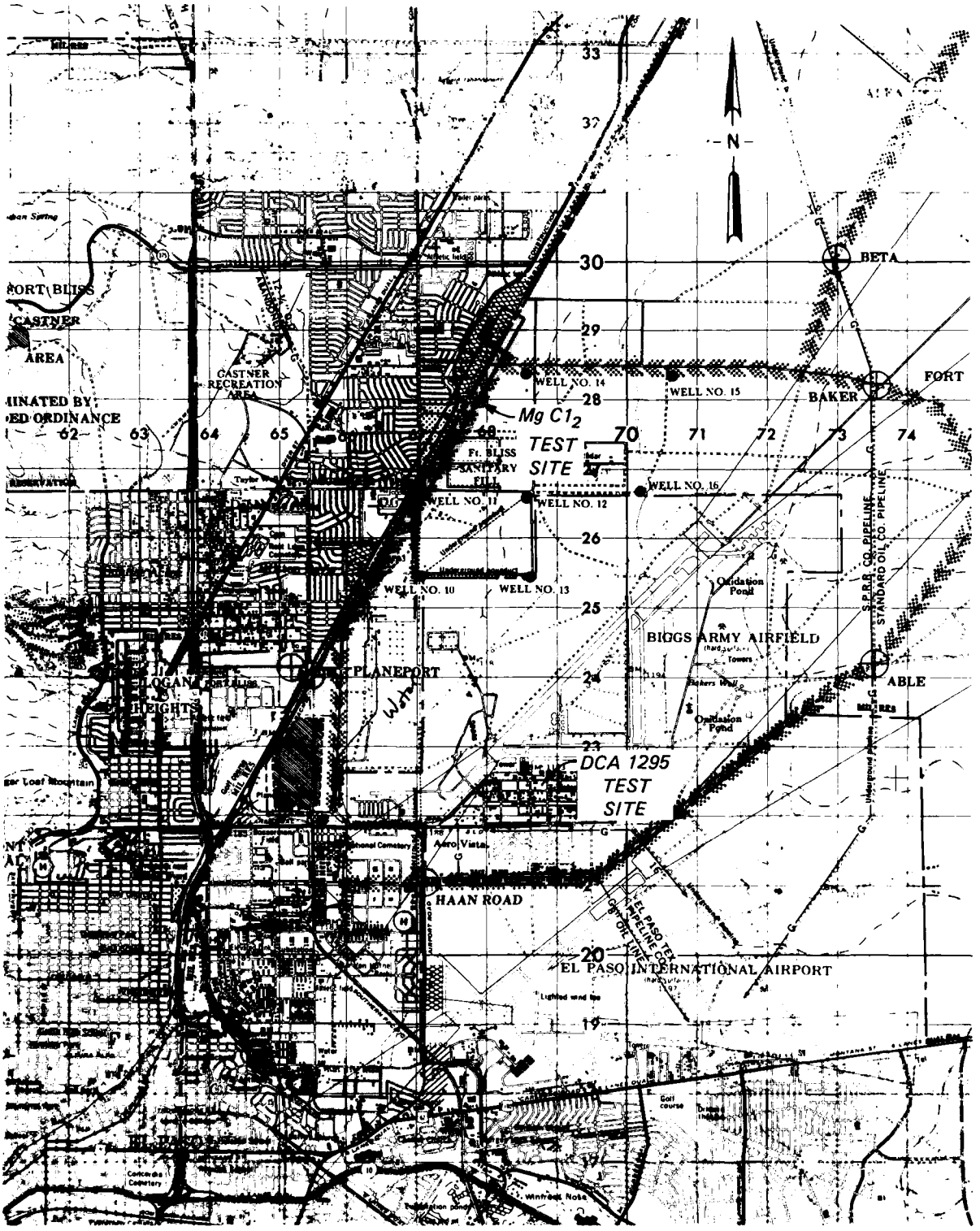


Figure 3. Fort Bliss, Tex., demonstration sites

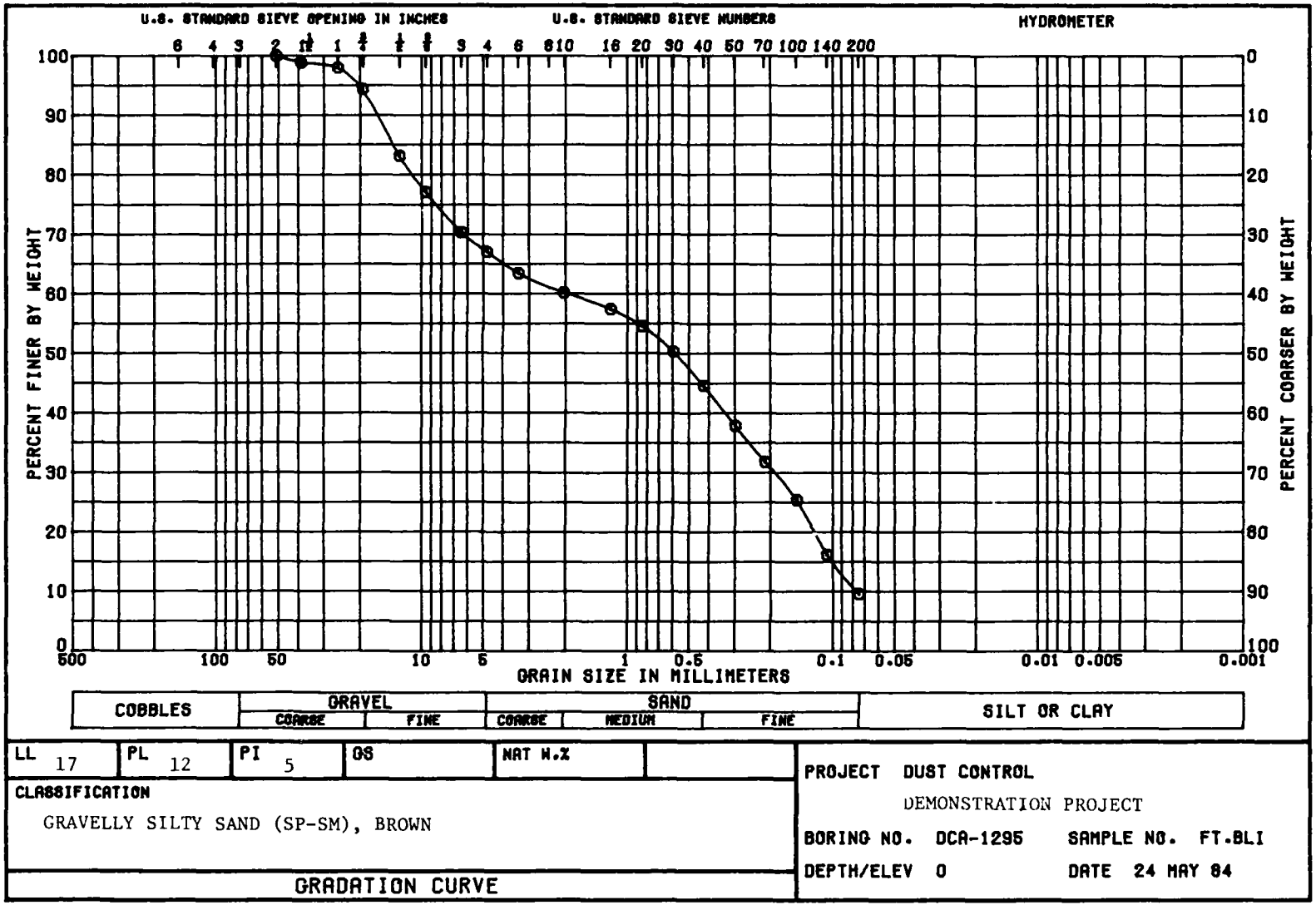


Figure 4. PVA site soil classification, Fort Bliss, Tex.

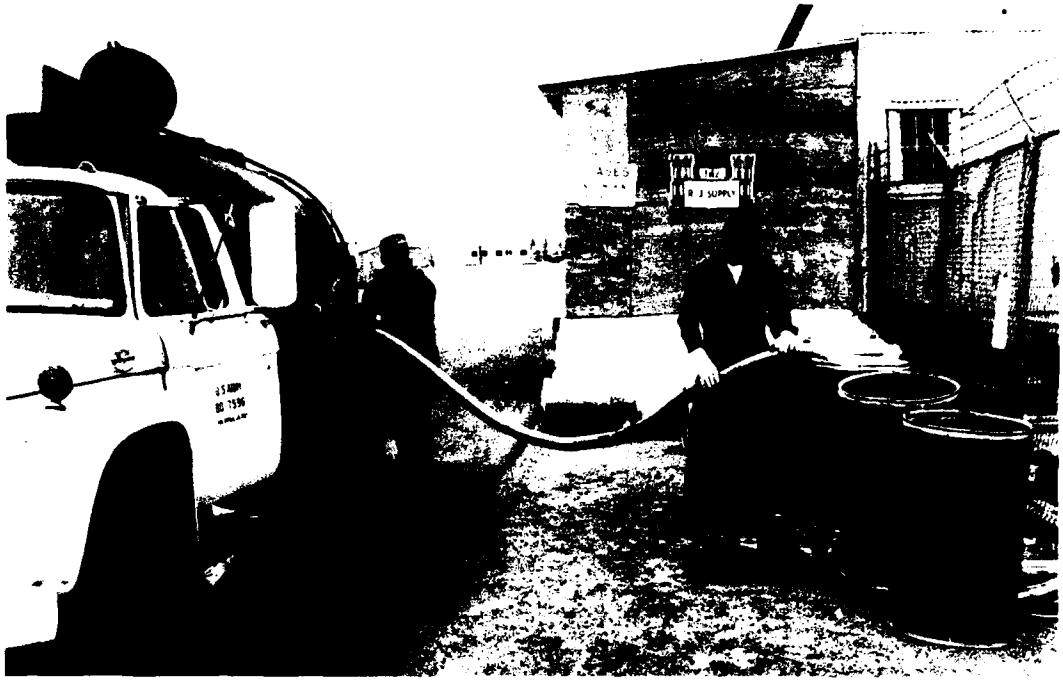


Figure 5. Loading PVA at Fort Bliss, Tex.

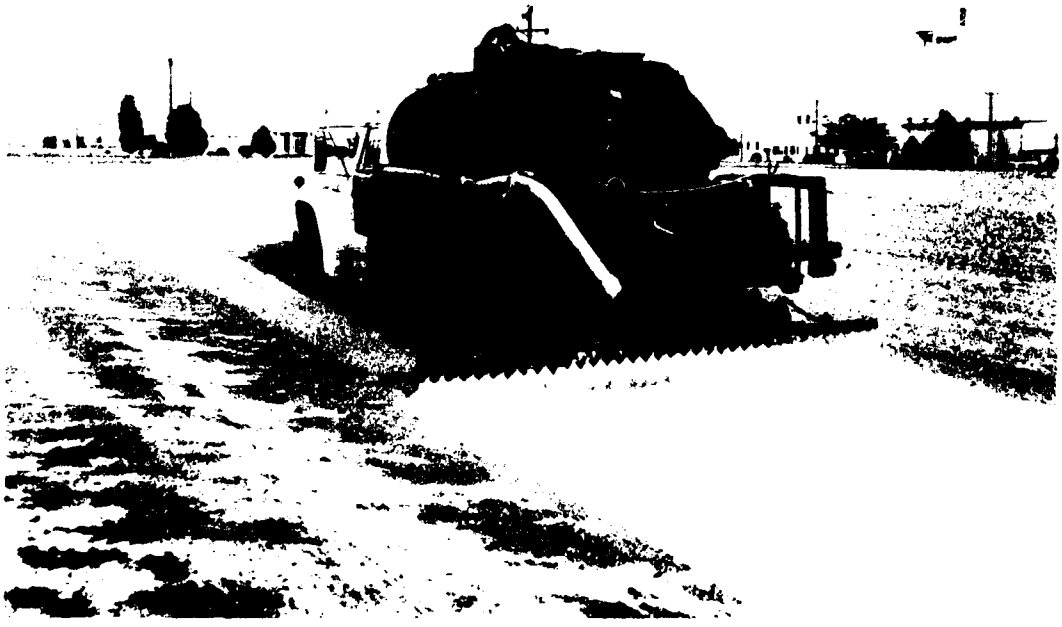


Figure 6. Applying PVA at Fort Bliss, Tex.

Figure 7. The PVA treated surface, Fort Bliss, Tex.

the surface down; if left undisturbed, it may take months to cure completely. This does not impair the dust control integrity of the treated area in any way.

29. Nine thousand gallons of $MgCl_2$ were placed on a tank trail adjacent to the Southern Pacific Railroad Line in the immediate vicinity of the Fort Bliss Sanitary Fill (Figure 3). Actually all types of wheel vehicles, both military and civilian, use this road in addition to the military tracked vehicles. The treated area was limited to 24 ft wide by 6,750 ft long. The entire road width, approximately 50 ft, was not treated in order to provide a dust free corridor for the tracked vehicles that extended the entire length of the adjacent commercial activities in this area. The road material was classified by the USCS as a brown gravelly clayey sand (SM-SC) (Figure 8). The test area is essentially horizontal with little or no grade.

30. The WES 900-gal capacity modified asphalt distributor was loaded directly from the railroad tank car used to ship the $MgCl_2$ (Figure 9). A special collar device was required to attach the distributor supply hose to the railroad tank car (Figure 10). The collar must fit a threaded pipe approximately 4-1/4 in. in diameter, turn 45 deg (preferably 90 deg), and the opposite end fit the 3-1/2-in. supply hose.

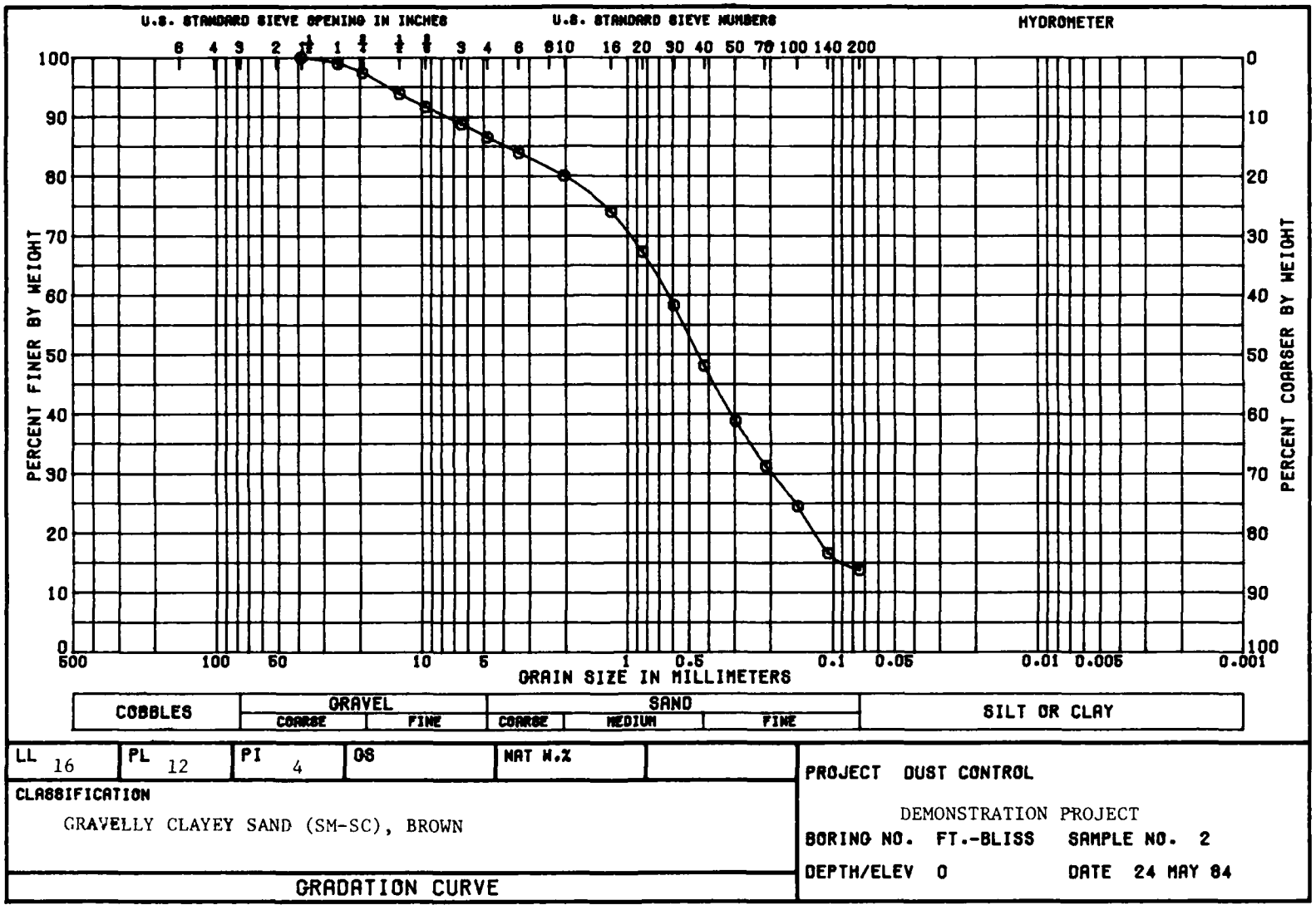


Figure 8. $MgCl_2$ site soil classification, Fort Bliss, Tex.

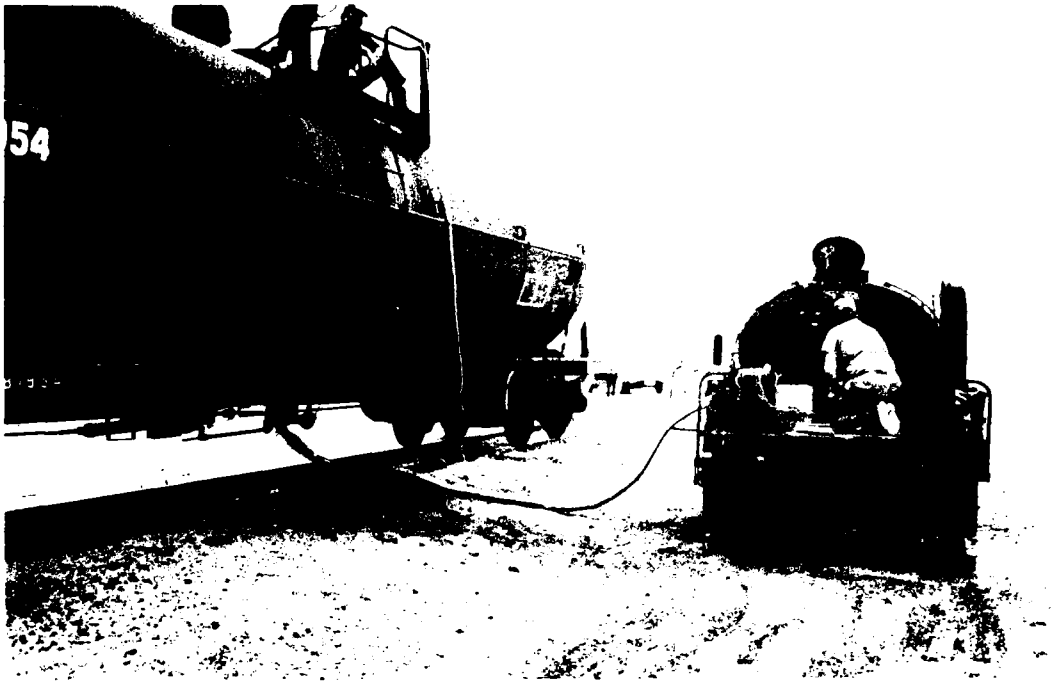


Figure 9. Loading product $MgCl_2$ from railroad tank car

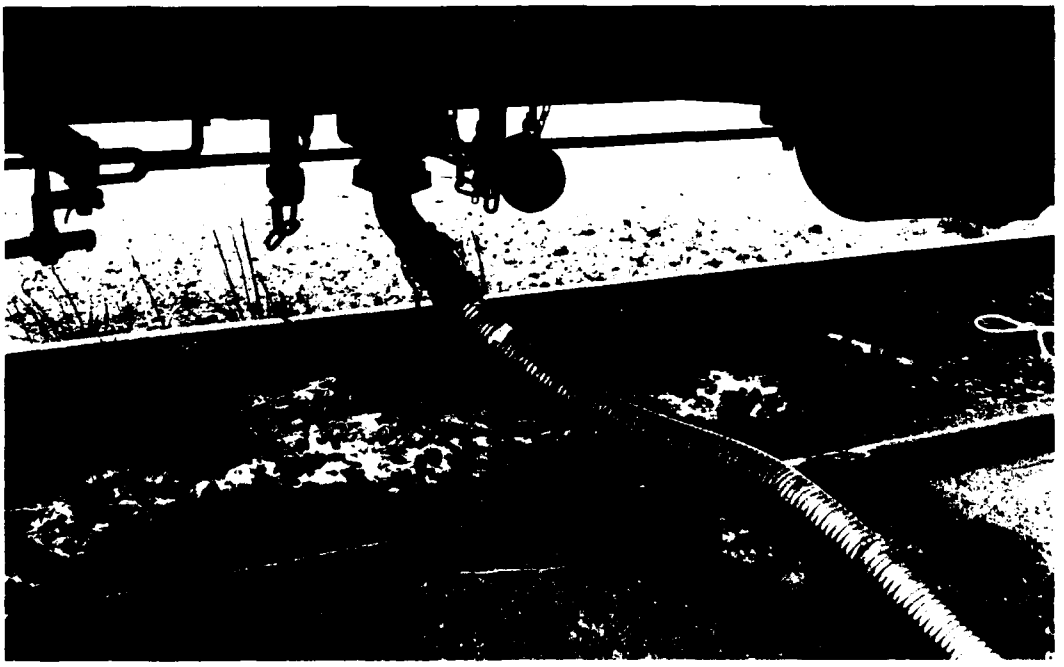


Figure 10. Collar device required for tank access

31. The application rate for the $MgCl_2$ was set in the same manner as described for the PVA. The actual application rate realized was very close to the desired rate, 0.5 gal/sq yd (Figure 11a). Product $MgCl_2$ requires no cure period and the treated areas can support traffic immediately (Figure 11b).

Fort Stewart, Ga.

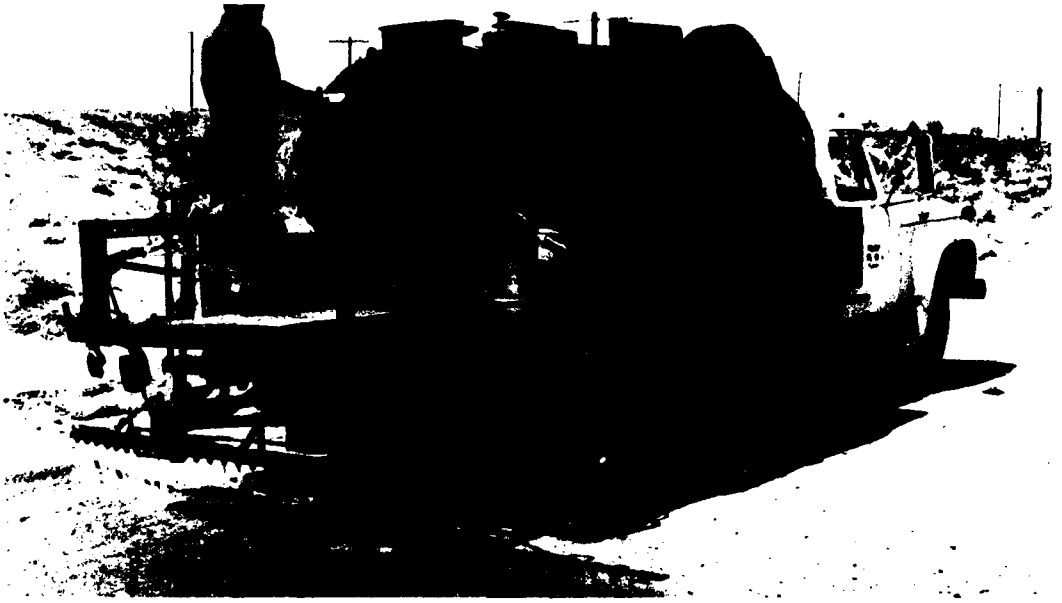
32. The Fort Stewart, Ga., demonstration was conducted during the period 30 April-4 May 1984. Two test sites were bladed smooth, and a water truck was provided for prewetting.

33. The PVA test site is in an area that is used to load and unload a warehouse located near Zoucks Cemetery (Figures 12 and 13a). Eighteen drums of PVA were diluted three parts PVA to one part water and applied to an area 200 by 90 ft for an actual application rate of 0.49 gal/sq yd (Figure 13b).

34. The PVA section was completed around noon of the second work day. Midmorning of the third work day, ruts and tears caused by numerous passes of at least two large vehicles were observed on the test section. Judging from the way the material stretched and pulled apart, the traffic occurred before the material had completely cured. Vehicles stopping with locked wheels and making fast circular turns had effectively rendered this dust control section an estimated 50 percent effective at this time (midmorning of the third work day) since a large amount of bare untreated material was exposed. Continued traffic of this type will completely destroy this test section. The test section is considered to be of no further practical interest to Facilities Technology Application Test (FTAT) or Research and Development. The two remaining drums of DCA 1295, which would have been used for hand-held spray bar touch-up (if needed) were not used. They would have been insufficient to repair all the damage sustained (Figure 14).

35. The $MgCl_2$ test area is an unsurfaced road (Fort Stewart 47) used primarily by tracked and other military vehicles. This road parallels Georgia 47 approximately 200 yd to the northeast. The test section begins at the intersection of Georgia State Highway 144 and Fort Stewart 47 and proceeds 4,860 ft southeasterly (Figure 12). The roadbed width varies but is approximately 30 ft wide. The roadbed surface was classified by the USCS as a brown silty sand (SP-SM) (Figure 15).

36. The test area was prewet, and the distributor speed and pump rate



a. Applying product $MgCl_2$ to tank trail

b. The $MgCl_2$ treated surface, Fort Bliss, Tex.

Figure 11. Product $MgCl_2$ application and treatment

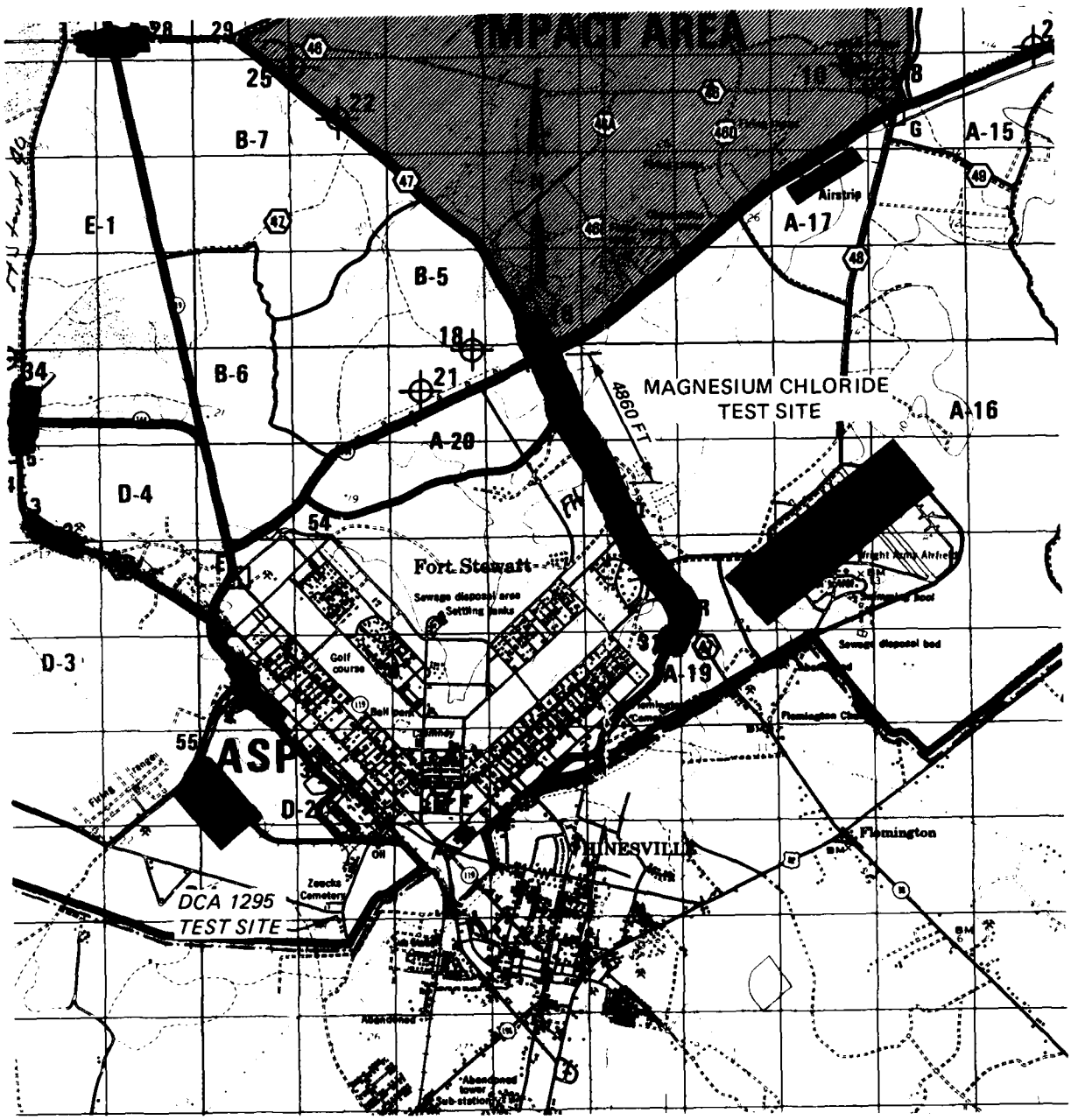
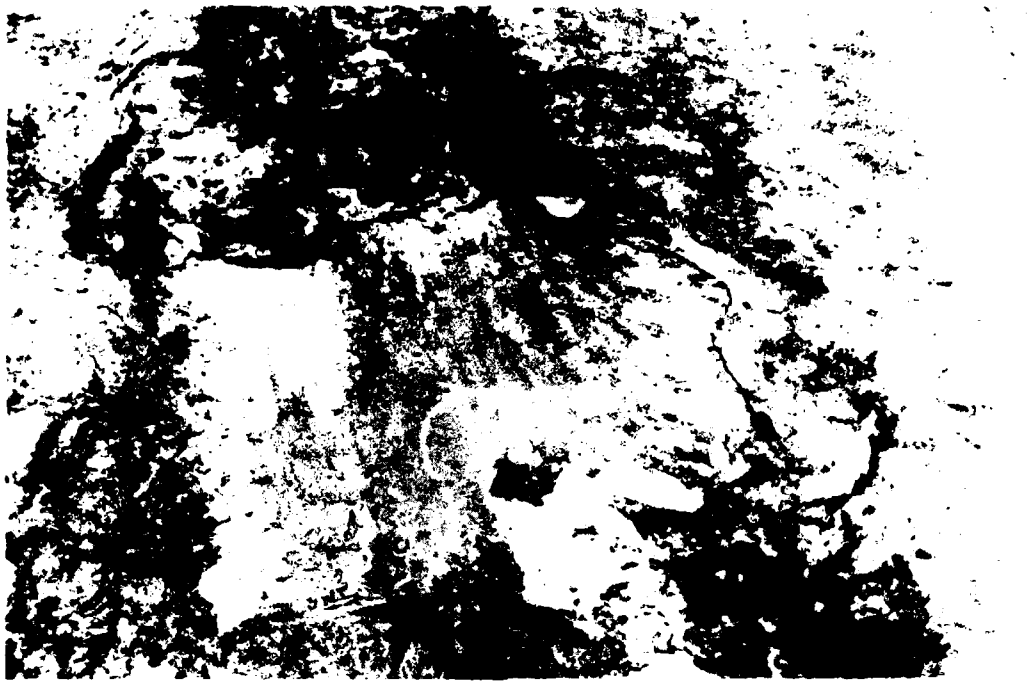


Figure 12. Fort Stewart military installation

a. PVA test site, Fort Stewart, Ga.

b. Applying PVA, Fort Stewart, Ga.

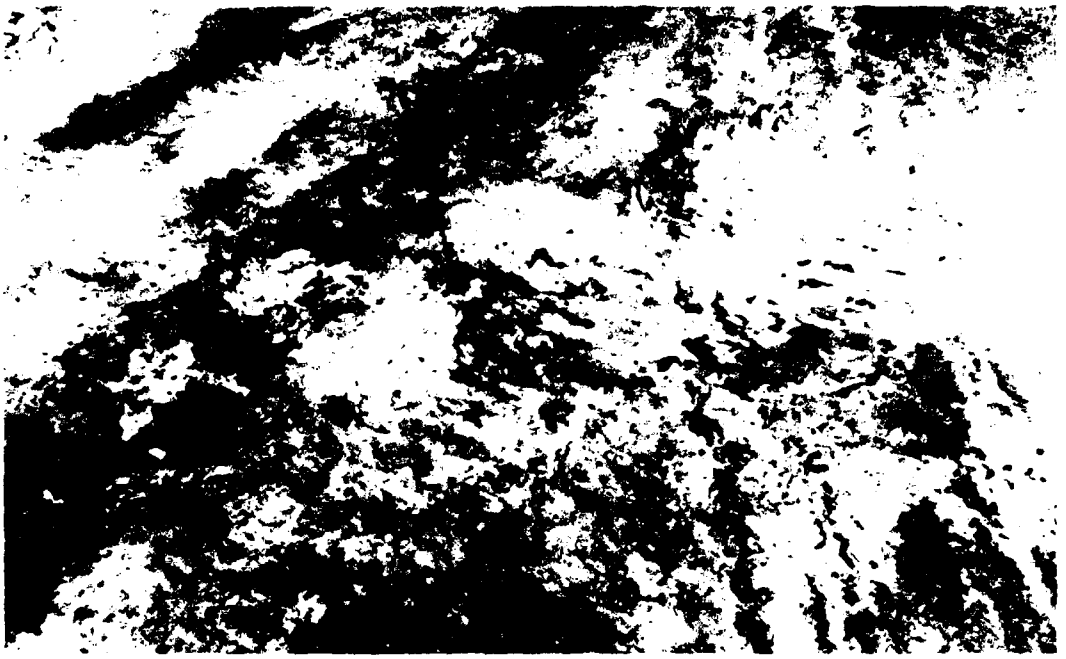
Figure 13. Test site and application of PVA



a.

b.

Figure 14. PVA wheel damage prior to cure, Fort Stewart, Ga.
(Sheet 1 of 3)

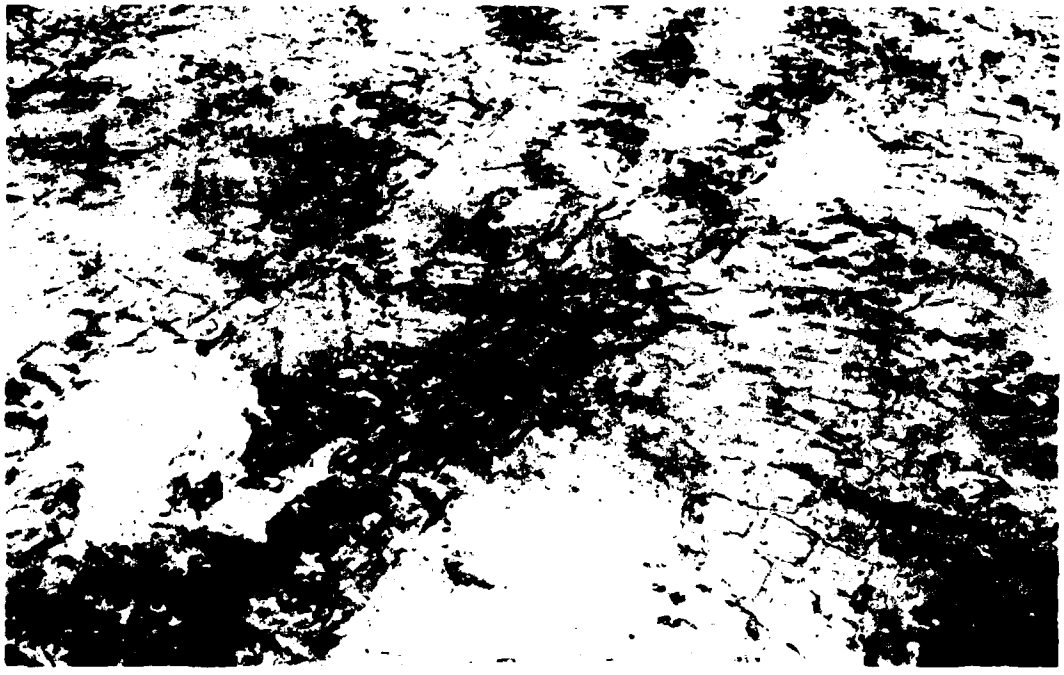


c.

d.

Figure 14. (Sheet 2 of 3)

e.



f.

Figure 14. (Sheet 3 of 3)

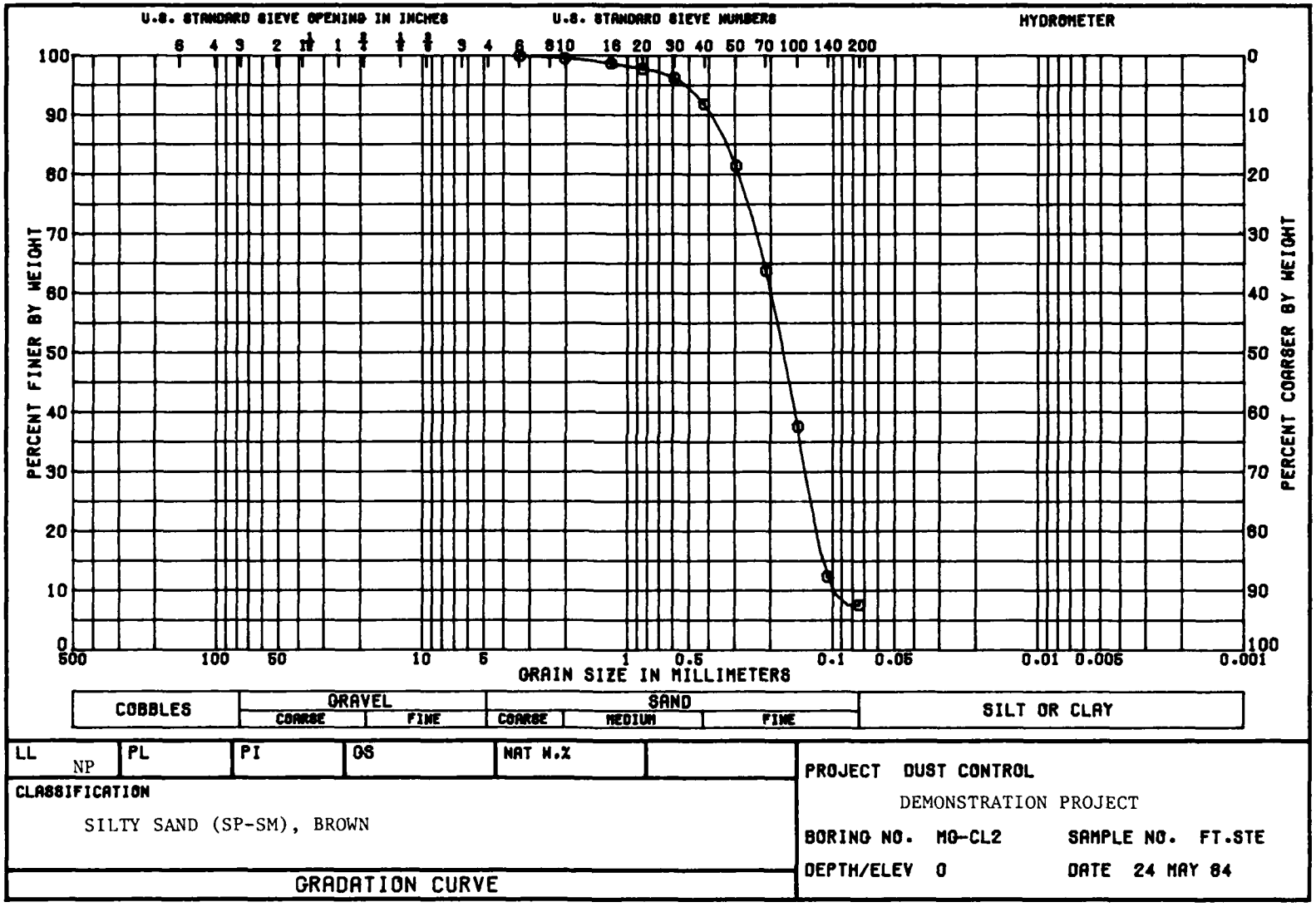


Figure 15. $MgCl_2$ site soil classification, Fort Stewart, Ga.

were set to apply the $MgCl_2$ at the rate of 0.5 gal/sq yd. The spray bar width was set at 10 ft, requiring that three passes be made. The resulting treated section was approximately 29 ft (with 6-in. overlap) by 4,860 ft. No runoff was permitted or observed.

37. Weather conditions during the Fort Stewart demonstration ranged from cool and cloudy to hot and sunny. An estimated 2 in. of rain fell on the $MgCl_2$ section with no noticeable reduction in performance of the dust control material.

PART V: ECONOMICS

38. Fact sheets were prepared for both products, $MgCl_2$ and PVA (Figure 16). Applying product $MgCl_2$ purchased at the bulk rate with no associated freight costs (the price is listed FOB Ogden, Utah) amounts to a material cost in place of $0.11/sq yd. Product PVA purchased at the bulk rate of $181.00/drum applied anywhere in the continental United States amounts to a material cost in place of $1.65/sq yd. Since application rates for each material are approximately the same, the overwhelming tendency may be to proceed with the cheaper product; however, the following advantages and disadvantages of each product should be considered before a product is purchased.

39. $MgCl_2$ is the most economically known product for controlling dust under tracked vehicles on cohesionless (sand and gravel) soils. It is not effective on fine-grained soil. Product $MgCl_2$ leaches with rainfall. In the southeast United States, the effectiveness of a 0.5-gal/sq yd application is reduced approximately 50 percent following a year's annual rainfall (50 to 60 in.).

40. Product PVA is the most economical product for controlling dust for CH-47 and C-130 aircraft. It is effective on all soil types and remains so for approximately 12 months, depending on actual use and weather extremes. (Weather extremes have been combated successfully with the addition of fiberglass scrim fabric at a cost of approximately $0.15/sq yd (Styron 1972, 1975).) Product PVA can be likened to spray painting in difficulty of applying, but the technique is readily acquired. Product PVA can be used at lesser rates and at greater dilutions for erosion control, both where vegetation is desired and where vegetation cannot be tolerated (Styron 1972, Oldham 1979).

41. The design life of both products is greatly enhanced when effort is directed to compacting the surface before treatment. Since these products impart little, if any, strength to the surface where applied, areas that will rut before treatment will rut following treatment, and rutting quickly destroys the dust control integrity of either material.

42. Evidence exists that both products benefit from successive treatments, and from periodic maintenance; however, all efforts to define these benefits have proven unsuccessful to date.

FACT SHEET

Product Trade Name:	Dustgard
Supplier:	Great Salt Lakes Mineral and Chemical Corporation P. O. Box 1190 Ogden, UT 84402 (801) 521-3556
Contact:	Ms. Julie Greenwald
Description:	Dustgard is a liquid brine composed mainly of $MgCl_2$ with other inorganic elements
Dilution:	None - applied as received
Application Rate:	0.5 gal/sq yd
Cost:	FTAT project - $33.54/drum; bulk cost - $39/ton FOB Ogden, UT
General:	This material is a liquid brine by-product of the Great Salt Lakes Mineral and Chemical Corporation mining operation. It is an amber liquid easily sprayed and mildly corrosive but harmless with basic hygiene practices.

Product Trade Name:	DCA 1295
Supplier:	Union Carbide Corporation 40 Veronica Avenue Somerset, NJ 08873 (201) 828-3793
Contact:	Mr. Kevin Kilelee
Description:	DCA 1295 is a proprietary product consisting of a polyvinyl acetate emulsion modified with plasticizers, surfactants, and other inorganic elements.
Dilution:	3 parts concentrate, 1 part water
Application Rate:	Depends on expected use but usually ranges from 1/3-2/3 gal/sq yd
Cost:	FTAT project - $235/drum FOB; bulk cost (1982) - $181/drum continental US.
General:	This material closely resembles white latex paint (if you can smell it during application, it is probably getting on your clothes which will be ruined when the DCA 1295 dries). The material dries in approximately 4 hr to form a clear, durable film. This material is harmless with basic hygiene practices.

Figure 16. Fact sheets for $MgCl_2$ and PVA

PART VI: ADVANTAGES AND DISADVANTAGES

43. As previously mentioned in this report, reducing the migration of the fine materials (i.e., controlling dust) reduces the formation of ruts caused when sufficient fines are displaced to render the larger particles unstable. By postponing instability and/or the formation of ruts, the need for blading, compacting, etc., is decreased resulting in lower maintenance costs. Actual dollar savings will vary with location and weather extremes during the period of observation. During a previous test of product $MgCl_2$ at Fort Stewart, Ga., Mr. Houston noted the need to blade their test area was reduced to about four times in the 12 months following treatment compared to the usual need of once a month (Houston 1983).

44. Neither product has been evaluated as to its environmental influence when used as noted above. Probably the practice of spraying both materials with a spray bar height of 6 to 10 in. above the roadway and ensuring the materials fall on the roadbed (only) with no runoff permitted provides an environmentally acceptable product. Product $MgCl_2$ is known to leach out of the treated material with time; however, a long time and/or considerable rainfall is required (Styron and Spivey 1982, Houston 1983) (as previously mentioned, this product was judged 50-percent effective following 12 months and/or 60 in. of rainfall).

45. Product PVA has the same base material as latex paint (approximately 80 percent) and should be no more harmful to the environment when it deteriorates than latex paint.

46. A dust control surface is not designed in the same sense as most engineering projects. A product is selected depending mainly on product cost and intended use of the dust control surface. Then the product is applied at a rate that avoids all runoff, usually 0.5 gal/sq yd. Maintenance or additional applications are scheduled as necessary depending on actual use and existing weather conditions. A combined Army and Air Force dust control manual exists for aid and assistance (Headquarters, Departments of the Army and Air Force 1974).

PART VII: CONCLUSIONS

47. The application and performance of two dust control materials were demonstrated at Fort Bliss, Tex., and Fort Stewart, Ga. The method of application, equipment required, and labor necessary to conduct a dust control project were described and explained. A video cassette was prepared for those who are interested in the products. Both products were observed to control dust; but the advantages and disadvantages of each, including costs, were presented.

REFERENCES

Headquarters, Departments of the Army and Air Force. 1974 (Sep). "Dust Control," Technical Manual TM 5-830-3/AFM 88-17, Chap. 3, Washington, DC.

Houston, T. D., Jr. 1983 (Jul). "In Place Performance Test, Evaluation Studies, Investigation of Magnesium Chloride for Dust Control," Technical Report V2 00092-2-J, Directorate of Engineering and Housing, Fort Stewart, Ga.

Oldham, J. C. 1979 (Feb). "Section 32 Program Streambank Erosion Control Evaluation and Demonstration Work Unit 4 - Research on Soil Stability and Identification of Causes of Streambank Erosion, Evaluation of Spray-On Stabilizers for Bank Protection," Investigation Report 1, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Styron, C. R., III. 1972 (Jun). "Erosion Control at the ARES Facility, Kirkland Air Force Base, New Mexico," Miscellaneous Paper S-72-27, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

_____. 1975 (Jul). "Jet Blast Tests on Fiberglass-Reinforced DCA-1295," Miscellaneous Paper S-75-21, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Styron, C. R., III, and Eaves, R. C. 1973 (Dec). "Investigation of Dust-Control Materials," Miscellaneous Paper S-73-70, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Styron, C. R., III, and Spivey, A. C., Jr. 1982 (Sep). "MX Road Design Criteria Studies, Report 2, Investigation of a Proprietary Material for Dust Control," Technical Report GL-82-11, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

APPENDIX A: POINTS OF CONTACT

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